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Quarterly Report on Project 15G-B2299

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I. MULTICHANNEL TELEMETRY

SCO's for temperature sensing have been completed in development. The center frequencies involved are 1.7 Kc/S, 3.0 Kc/S and 5.4 Kc/S.

The SCO development at f_c = 10.5 Kc/S for ECG use has been temporarily put aside as we study its extension for use as a very high impedance, high sensitivity dc channel. This is of considerable importance in relation to our electrode work and for possible application to blood flow sensors. Extremely simple circuits permit modulation (lower limit) with input levels of about 1 mv, peak-to-peak. We should like to improve this situation by a factor of about 100.

The problem is quite severe particularly from the viewpoint of stability and noise as a function of temperature and power source voltage.

We shall continue this particular attack during the next quarter.

II. TRANSDUCERS

The preparation of electrodes for use in telemeters is progressing satisfactorily. Materials for sealing the metal electrodes to glass have been tested. Epoxies, waxes, shellacs, pure and modified with fillers, and at different proportions of hardener to resin have been investigated. The chief difficulty is not water absorption as is usually tested and reported in the commercial and telemeter literature, but rather the adhesion between the glass and cement surface. A thin film on the order of a few wavelengths of light as can be seen from interference fringes, forms progressively from the edge of the bond inwards. This film of water effectively lifts the cement from the glass during prolonged immersion. Treatment of the glass surface chemically to obtain an extremely clean surface does not seem to help. Heating of the glass surface to about 300°C. to dry off absorbed moisture has shown some limited effectiveness. Tests have been performed on the various elements by placing about 50 one to three millimeter diameter spots on a cleaned microscope slide. The cement is cured for the desired time-temperature cycle, and a few spots are tested by means of a needle probe for hardness and adhesion. The slide is immersed in either distilled water or normal saline for approximately a week and a few more spots are tested. This procedure is continued. A few epoxies have proved to be the best and are currently being used in the fabrication of electrodes. While these epoxies are probably not suitable for long-term immersion (6 months

or longer), they seem to be quite good for shorter periods of time and will allow development of the actual electrodes to continue.

Silver-silver chloride electrodes have been made using commercially pure silver wire .025" diameter and approximately 1 cm long. These have been sealed (with epoxy) into glass and then chlorided. Most pairs will show less than two or three millivolts inter-electrode potential when freshly made and after shorting and ageing in a conductive solution will show only a fraction of a millivolt between pairs. This shows that the process is under excellent control and essentially indicates that it is a good process. Some of these electrodes have been coated with Sylgard, a Dow Corning transparent silastic. This silastic is permeable to water and these electrodes, on preliminary measurements, show no difference from uncoated ones with respect to potential and appear to stabilize quite rapidly.

A method of obtaining a long lasting intervening film of KCl between the AgCl and the silastic is being developed. The KCl is useful, but not absolutely necessary to obtain a stable and small junction potential. The AgCl electrode without KCl intervening is sensitive to chloride concentration of the medium being measured. The Ag-AgCl-KCl Sylgard electrodes, if successful, will be used as the reference electrode against many other type electrodes and especially against a pH electrode.

For the first attempts at a pH electrode an iridium metal electrode will be used. Some little information on this is given in Reference Electrodes, Ives and Janz, Academic Press. Iridium metal wire 99.9+% has been ordered for this use, but has not yet been received. Work will be carried out in evaluating this material as a pH electrode in the next quarter. Miniaturization and life tests will proceed from that point.

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